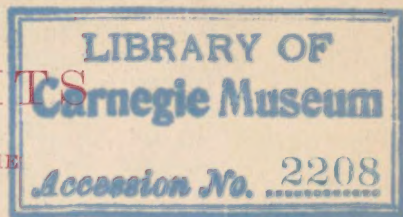


DESCRIPTIVE
CATALOGUE

OF
EXHIBITS

RELATING TO THE



FISHERIES OF JAPAN

AT THE

WORLD'S COLUMBIAN EXPOSITION

HELD AT

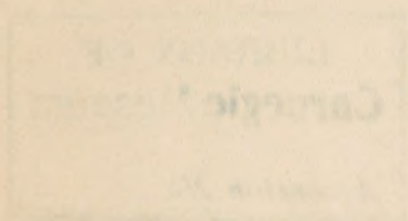
CHICAGO, ILL., U. S. A.

FROM THE

BUREAU OF AGRICULTURE
DEPARTMENT OF AGRICULTURE AND COMMERCE
IMPERIAL JAPANESE GOVERNMENT

—
1893

A large, stylized decorative pattern at the bottom of the page, consisting of dark, swirling, wave-like shapes with circular accents, resembling a traditional Japanese wave motif.



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INTRODUCTORY REMARKS.

THE present series of exhibits has been brought together in order to give the visitor a glimpse into the fishing industries of the Japanese Empire. When the varieties of objects sought after are so numerous, and the methods employed for obtaining them are so diverse, as is the case in extensive fisheries, it becomes a serious question how appropriate selections may be made so as to form a sufficiently comprehensive and representative collection. In the present case, after much deliberation, the following plan has been adopted. Out of the animals and plants that are found in our waters, those kinds were at first selected whose respective annual yield exceeds 10,000 *yen*. As this, however, was found to exclude many objects which are of peculiar interest, exceptions have been freely made in favour of such special cases. The final selections as displayed in the present series consist of one hundred and thirty-eight species of animals and plants distributed as follows:

Mammals.....	3 species
Reptiles	2 "
Fishes	85 "
Mollusca	33 "
Crustacea	11 "
Algae.....	4 "
Total	138 species.

Of these species, alcoholic specimens as far as possible, or photographs from actual specimens where they are too large, are displayed. Only in one or two cases of exceptional nature it has not been possible to follow this rule. The species are arranged in the order of their scientific classification, beginning with the Cetacea and going down the animal scale. Four species of sea-weeds which are of great commercial interest are placed at the end.

Out of the one-hundred and thirty-eight species mentioned above, those which are of great economic or social importance and are likely

to interest the American and European public, have again been selected and made the subjects of a somewhat exhaustive display. Of each of these kinds, in addition to the alcoholic specimens or photographs, are given a map showing the distribution of the species, the various devices employed for catching it such as hooks, traps, lines and nets, together with methods of culture where there are such, and finally the different articles manufactured from it. In some cases where this full treatment is not possible or essential, only a part of the programme has been carried out. The following subjects have been treated in this full manner, viz :—the Whales and Dolphins, the edible Turtles, the "*Tai*," the Mackerel, the Tunny, the Bonito, the Cod, the Soles and Flounders, the Carp (with the Goldfish), the Salmon, the "*Ayu*," the Sardine, the Herring, the Oyster, the Shrimps and Lobsters, and the Algae before referred to.

By the adoption of this plan, it is hoped that a fairly representative display of the fishing industries of Japan has been secured.

The models of nets, boats, etc., have been made with the strictest fidelity to the originals, even in minute details so that the actual things may again be constructed from them. Only as it is impossible to reduce the size of the meshes in nets on the same scale with other parts of the models, the proportions of meshes in different parts of large nets are alone intended to be displayed.

When the size of the meshes is given in the description of the nets, it is to be understood as the distance between every two knots on the same straight line, when they are pulled as far apart as possible.

The prices given in the following pages are all wholesale prices in the Japanese market. A *yen* (=100 *sen*) is equal at the present rate of exchange to \$ 0.65½ U. S. gold.

The numbering of all exhibits, whether they are specimens, models, or manufactured articles, is consecutive and without distinction. In the present catalogue the number and name of the first exhibit belonging to any one species is printed in heavy-faced type.

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WHALE AND DOLPHIN FISHERIES.

No. 1. *Delphinus longirostris*, Gray. (Jap. *Iruka*).
 Photograph.

Of the whales, *Balæna Japonica* (Jap. Semi-Kujira), *Rhachianectes glaucus* (?) (Jap. Ko-Kujira), *Megaptera boops* (?) (Jap. Zatō-Kujira), *Balenoptera arctica* (Jap. Iwashi-Kujira or Katsuwo-Kujira), *Sibbaldius sulfureus* (?) (Jap. Nagasu-Kujira), *Physeter macrocephalus* (Jap. Makkō-Kujira), and *Hyperoodon rostratus* (?) (Jap. Kuchi-Kujira), are found in the seas adjacent to Japan; and of the dolphins and porpoises, *Neomeris phocaenoides* (Jap. Sunameri), *Globicephalus Sieboldii* (Jap. Gotō-Kujira), *Grampus sakamata* (Jap. Sakamata), and *Delphinus longirostris* (Jap. Iruka), of which, however, the last mentioned species is the most common.

No. 2. Dolphin Net. 二ツツ.

This net is used at Tago in the province of Izu. It consists of three separate nettings, called respectively the "closer," the "seine," and the "tuck-seine." The first is used for closing the mouth of the bay when the dolphins have entered it. It is made of straw ropes and the meshes are about two feet and five inches. The seine is used for encircling the dolphins and drawing them near the land. Its central portion is made of

hemp, and the meshes are here about eight and a half inches ; while the two lateral portions are made of straw ropes with meshes of from about two feet to two feet and five inches. The tuck-seine is used for finally landing the dolphins. It is made entirely of straw and the meshes are about eight and a half inches. Six boats are attached to it as floats.

No. 3. Dolphin Oil.

No. 4. Crude Rorqual Oil.

No. 5. Refined Rorqual Oil.

These are all manufactured by the Tokyo Fish Oil and Wax Company, and are exported to London. Price of oil per hundred pounds six *yen*.

No. 6. Crude Sperm Whale Oil.

No. 7. Refined Sperm Whale Oil.

No. 8. Refined Rorqual Wax.

No. 9. Crude Spermaceti.

No. 10. Refined Spermaceti.

Both the oil and the wax of the sperm whale are produced only in small quantities. The price of the oil per hundred pounds is six or seven *yen*, while that of the spermaceti is from fifteen to eighteen *yen*. The price of the Rorqual wax is from thirteen to sixteen *yen* per hundred pounds.

SNAPPING TURTLE CULTURE.

No. 11. *Tryonix Japonicus*, Schleg. (*Jap. Suppon*), 1st yr. after [hatching.

No. 12. " " " " 2nd "

No. 13. " " " " 3rd "

No. 14. " " " " 4th "

The Snapping Turtle is found in all parts of Japan in rivers and marshes, and is highly esteemed for the flavour of its flesh. Recently, special attention has come to be given to its cultivation. The specimens here exhibited are from the hatching grounds of Mr. Kurajiro Hattori of Tokyo. The breeding season is from the latter part of May to the first part of July, and the same individual is said to deposit eggs more than once in the course of a single

season. The food consists of fish, shell-fish, and worms. From about the middle of October to April of the next year the Snapping Turtle hibernates in the mud. Specimens two years old weigh from 8 to 13 oz. Those weighing about 80 oz. are more than ten years old.

No. 15. Map of the Snapping Turtle Farm.

The farm represented by the map is that of Mr. Kurajiro Hattori of Tokyo. The pond has a muddy bottom, and its depth is about one foot near the banks and about three feet in the central part. The eggs are deposited in the sunny part of the bank. In the sandy area around the pond, which easily becomes dry, fences are erected to prevent the escape of the turtles. When the season for depositing the eggs is over, wooden boards of about one foot in height are erected on the lower margin of the bank, and between these, sheets made of reeds or bamboo splints are placed to protect the broods from the attacks of their parents and other foes. Within the barrier are buried numerous pots to afford shelter to the newly hatched turtles.

No. 16. Canned Snapping Turtle.

This is made by the Kōsangi-Sha of Yanagawa in the province of Chikugo. It has a large demand owing to its fine flavour and nutritious properties. Price per dozen, *yen* 3.60.

No. 17. Canned Green Turtle.

This is made by the Kairiku-Sha of Tokyo. Price per dozen, *yen* 1.80.

No. 18. *Megaperca ischinagi*, Hilgd. (*Jap. Ishinagi*).

Alcoholic specimen.

No. 19. *Percalabrax Japonicus*, T. & S. (*Jap. Suzuki*).

Alcoholic specimen.

No. 20. *Anthius Schlegelii*, Blkr. (*Jap. Akasagi*).

Alcoholic specimen.

No. 21. *Scombrops chilodipteroides*, Bleek. (*Jap. Mutsu*).

Alcoholic specimen.

No. 22. *Nippon spinosus*, C. & V. (*Jap. Ara*).

Alcoholic specimen.

No. 23. *Therapon oxyrhynchus*, T. & S. (*Jap. Shima-Isaki*).
Alcoholic specimen.

No. 24. *Synagris Sinensis*, Lacép. (*Jap. Itayori*).
Alcoholic specimen.

TAI* FISHERY.

No. 25. *Pagrus tumifrons*, T. & S. (*Jap. Hanaore-Dai*).
Alcoholic specimen.

No. 26. *Pagrus cardinalis*, Lacép. (*Jap. Kasuko-Dai*).
Alcoholic specimen.

Beside the species named above there are in Japan two other species of the genus, viz., *P. major* and *P. ruber*; but *P. cardinalis* is the most abundant. The "*Tai*," as the Japanese call the scup, is the most highly esteemed of all food-fishes, and no feast can be complete without it. The *Tai* of the market is generally from one to two feet long. The price of a fresh *Tai* one foot in length is often more than a *yen*. The *Tai* is a bottom fish preferring sandy or muddy places. It feeds on other fishes, shell-fish, and annelids. In the early part of summer it migrates from the deeper to the shallower seas, where it spawns; and in the autumn it again seeks its deep water haunts. In the south-western provinces, the chief supply of the market-fish comes from the Inland Sea, the middle portion of which is a favorite spawning ground. The *Tai* enter the sea through its eastern and western channels, and returning seek the ocean by the same route. In the north-eastern part of the country the spawning season is July and August. The *Tai* is found in all parts of the country, as may be seen by the accompanying map showing its distribution.

No. 27. Map showing Distribution of the *Tai*.

APPARATUS FOR TAI FISHING.

Long lines, hand lines, and several nets are used.

No. 28. Box of Long *Tai* Line (with floats and wooden grapnel).

This is used at Misaki in the province of Sagami. It is a long line bearing a certain number of snoods about 20 feet long. A section of about nineteen hundred feet of the line bearing eighty-

* Changed into *Dai* for the sake of euphony when compounded with a prefix.

five snoods is put into a shallow round wooden box. A single boat manned by six or seven men often works a line of as many as twelve of these sections.

A stone and a barrel buoy are attached to each section of the line as it is let down, except the first to which is attached instead of the stone a wooden grapnel to fasten it to the bottom. When the whole line has been let down, a stone and a buoy are tied to its end; the boat is then rowed back, and the line is taken up from its beginning. For bait spoon-worms (*Echiurus*), sardines, and squids are used.

No. 29. Tai Hand Line.

The portion consisting of silk-worm gut is kept coiled around a circular disk-shaped box of wood, and the silken part is kept reeled lengthwise of a bamboo rod.

The whole length of the line is 160 feet, of which the leader 100 feet in length is made of silk-worm gut, the remaining part being of silk. At three points a lead of $\frac{1}{10}$ — $\frac{1}{5}$ oz. is tied to hold the line against the currents. When the line is used, the bamboo rod on which the line was reeled is used as a fishing rod.

For bait shrimps covered with *Mysis* are used, the *Mysis* serving as a toll bait.

No. 30. Tai Hooks.

A collection of hooks used in various parts of Japan. Those made of brass are mostly used with the long line, while those of iron are generally used with the hand line. They are of various shapes; some being angular, while others are curved; some possessing barbs, others having none, while in still others the end is bent laterally at an angle. Some are made simply by bending a wire, while others are carefully tempered.

No. 31. Tai Scare-cord Seine. 網子.

This net is called "*katsura-ami*" by the native fishermen from the idea that its scare-cord resembles in appearance the stem of the ivy (*katsura*=ivy, *ami*=net). The meshes are largest near the ends of the two wings, where they measure about 5 feet, and gradually diminishing in size become at last about half an inch in the central portion. The portion with smaller meshes is made of hemp, while those portions which have larger meshes are made of straw. The net is divided along its middle line into two portions which are joined together when used.

The scare-cord is made of hemp and is about 3750 feet long. To it are attached at intervals of two feet thin rectangular pieces of wood. Also to keep the cord in a horizontal position at a proper depth, stones and barrel buoys are tied to it.

To work the net, each end of the scare-cord is kept by a boat. The two boats keeping at a convenient distance from each other row in conjunction, and gathering together the scattered fish, scare them on to the net which is kept spread by two other boats which also gather it in after the fish have entered.

No. 32. Tai Scare-cord Seine Fishing.

The two boats in the distance have done their work with the cord, and the men in the other two boats have almost drawn up the net and are bailing out the fish from it.

PREPARATIONS OF TAI.

The *Tai* is preserved in various ways, viz., with salt, by being opened and dried; or by being boiled and crushed; or again by being made into wafers. Salting is however the chief means of preservation.

No. 33. Tai Wafers.

These are excellent for making soup. Neither taste nor color is affected by lapse of time.

No. 34. Mashed Tai. (*Jap. Tai-Dembu*).

This is very excellent for making broth. It has a delicate flavor which is very delicious. The price is about 50 *sen* a pound.

No. 35. Salt Tai.

This is largely made along the southern Pacific coasts of Japan; more than ten thousand casks being produced every year. The price varies according to the size and quality of the fish salted, but about five *yen* a hundred pounds may be taken as the current wholesale price.

No. 36. *Chrysophrys hasta*, Bleek. (*Jap. Kuro-Dai*).
Alcoholic specimen.

No. 37. *Sebastes* sp. (*Jap. Mobaru*).
Alcoholic specimen.

No. 38. *Apistus Matsubaræ*, Hilgd. (*Jap. Ako*).
Alcoholic specimen.

- No. 39. *Beryx decadactylus*, B. & V. (*Jap. Kimme-Dai*).
Alcoholic specimen.
- No. 40. *Sciæna sina*, C. & V. (*Jap. Ishimochi*).
Alcoholic specimen.
- No. 41. *Sciæna Japonica*, Schleg. (*Jap. Nibé*).
Alcoholic specimen.
- No. 42. *Trichiurus lepturus*, L. (*Jap. Tachino-Uro*).
Alcoholic specimen.
- No. 43. *Trachurus trachurus*, L. (*Jap. Mă-Aji*).
Alcoholic specimen.
- No. 44. *Caranx muroadsi*, T. & S. (*Jap. Muro-Aji*).
Alcoholic specimen.
- No. 45. *Caranx maruadsi*, T. & S. (*Jap. Maru-Aji*).
Alcoholic specimen.
- No. 46. *Seriola quinqueradiata*, T. & S. (*Jap. Buri*).
Photograph.
- No. 47. *Xiphias gladius*, L. (*Jap. Mekajiki*).
Photograph.
- No. 48. *Histiophorus orientalis*, T. & S. (*Jap. Bushō-Kajiki*).
Photograph.
- No. 49. *Stromateus argenteus*, Bl. (*Jap. Mana-Gatsuo*).
Alcoholic specimen.
- No. 50. *Coryphæna hippurus*, L. (*Jap. Shiira*).
Photograph.

MACKEREL FISHERY.

- No. 51. *Scomber colias*, L. (*Jap. Sāba*).
Alcoholic specimen.

Fishermen distinguish several kinds of "saba," such as "maru saba," "hira saba," and "goma saba;" but they are probably to be regarded merely as varieties of the species named above. This species is always found in or near the *Kuro-Shingo* or Black Stream; but nothing is as yet known about its migration. In its pursuit of prey it comes into bays and shallow waters near the coast, and can then be caught with ground-seines. At night it

is easily attracted by light, and the fishermen take large shoals by burning torches in their boats.

The food of the mackerel consists principally of sardines, small crustaceans, squids, and pteropods; but it is not very fastidious in its taste and takes even salt fish. Spawning takes place in April and May. Large specimens often measure about two feet in length and weigh about six pounds.

No. 52. Map showing Distribution of *Scomber colias*.

APPARATUS FOR MACKEREL FISHING.

Mackerel fishing is carried on in all parts of Japan. Both nets and lines are used for the purpose; but the latter are by far the more effective means.

No. 53. Basket of Long Mackerel Line (with barrel buoy).

This line is used at Misaki in the province of Sagami. It is about 350 feet long bearing 85 snoods of about two feet. Fourteen baskets of this line are usually worked by a boat of six or seven men. When being used, the line is kept floating at some intermediate depth by means of five barrel buoys attached to the principal line by means of ropes 300–350 feet long. As ballast a small stone is tied to the lower end of each hanging rope. Beside these, nine smaller stones are attached at intervals to the whole line.

No. 54. Mackerel Hand Line (local name *bishi*).

This line is used at Misaki in the province of Sagami. It consists of a piece of brass wire bent in the middle so as to form a loop the two ends of which diverge from each other. The wire is then attached by the loop to a line consisting of three strands coiled together, and measuring about 250 feet in length. Each end of the wire bears a snood of silk-worm gut, and to the loop are attached a conical piece of lead and a bag containing bait.

This line is worked by night and at a depth of 10–50 fathoms with good tidal currents; large shoals being made to gather by torch- or lamp-light.

For bait sardines and mackerel are chiefly used. When these can not be obtained fresh, salt sardines or salt mackerel are used; the small bag attached to the loop contains minced flesh of these fish, which acts as a toll bait.

The mackerel is caught in considerable numbers in the spring and autumn, but also more or less throughout the year.

No. 55. Mackerel Hand Line Fishing.

The man at the bow has succeeded in hooking a fish which he is lifting in; the one at the middle of the boat has let down his line and is alternately raising and lowering it; another is baiting his hook; and the man at the stern tries to keep the boat against the tide by working at the oar.

No. 56. Hooks for Mackerel.

A collection of hooks used for mackerel in various parts of Japan. They are made of iron or brass, and are barbed and tempered.

No. 57. Mackerel Torch-light Net. $\frac{1}{2}$ 5.

This is used near the coast of the southern parts of Japan. The whole is a rectangular net 60 feet by 210 feet; the central portion being made to hang down slack and form a sort of bag. Its meshes vary in different parts from half an inch to about six inches. Four ropes made of straw are tied to the short sides of the net and five to the long sides. At the junction of the net and the rope a stone (of 8-10 lbs.) is attached.

The net is first of all kept spread flat by four boats holding the ropes tied to the sides. Two boats with dragons then row on to the middle of the net. A large number of mackerel attracted by the lights follow them. Then the men in the four boats begin to work in the ropes, and the boats with dragons extinguish them and row out of the net.

This mode of attracting large numbers of the mackerel with torch-lights has been in use in Japan for four hundred years.

No. 58. Mackerel Torch-light Net Fishing.

PREPARATIONS OF MACKEREL.

There are three ways of preserving the mackerel, viz., drying, canning, and salting. Of these salting is carried on on an extensive scale in every part of Japan. In recent years various improvements, such as the use of specially selected salt, have been introduced, and fine salt mackerel is now not a rare article in the market. If there should be any demand for exportation in future, this mode of curing would doubtless attain a still higher degree of perfection.

No. 59. Salt Mackerel.

The smaller cask contains eight or nine mackerel of 1-1½ feet weighing altogether about ten pounds; and the larger, fourteen

mackerel together weighing twice as much as the former. The price is at present 1 *yen* for the smaller cask, and 2 *yen* for the larger. The produce of recent years has been as follows:

1890.....	234,561 <i>yen</i> .
1891.....	183,686 „

No. 60. Canned Mackerel.

Boiled and canned by the usual methods. The price is about one dollar a dozen.

TUNNY FISHERY.

No. 61. *Thynnus sibi*, Schleg. (*Jap. Shibi*).

Photograph.

No. 62. *Thynnus albacora*, Lowe. (*Jap. Kiwada-Shibi*).

Photograph.

The tunny moves in large shoals in the *Kuro-Shiwo* but never enters bays or inland seas. It is carnivorous and feeds on small fishes and squids, being often seen dancing around shoals of small fish and eating them. It is very quick in its movements and is a good swimmer. Specimens 5 feet long and weighing more than one hundred and twenty-four pounds are quite common. The tunny is caught throughout the year, but summer is the best fishing season.

No. 63. Map showing Distribution of Tunny.

No. 64. Long Tunny Line (one basket, with float and stone).

This is used at Misaki in the province of Sagami. It is a cord of about 1250 feet with ten snoods about 5 ft. long, and is worked at a depth of more than 400 feet. Both the cord and the snoods are made of hemp, and put into shallow baskets. Two boats with eight or nine men each usually work 12 basketfuls of the cord. To use it, five stones weighing about twenty-seven ounces apiece are tied to the cord; also at each end of it is attached by means of a cord about 300 ft. long a rod of *Paulownia imperialis*. To these again is tied at right angles a long stem of bamboo, at the top of which some easily observable signals are placed. The principal cord does not reach the bottom of the sea, but is kept suspended at some intermediate depth. For bait squids and horse-mackerel are used.

No. 65. Long Line Tunny Fishing.

A scene at the entrance of the Bay of Tokyo. Two men are working in the cord by hand, and another is aiming the lance at the fish.

No. 66. Tunny Hooks.

A collection of hooks used in various parts of Japan. They are all made of brass castings.

No. 67. Tunny Pound-net (with a watch-tower). 一五〇.

This is a fixed net made of straw on a large scale and with great art. It is used at the extremities of wooded promontories in the vicinity of Nagasaki. It consists of two principal parts, the leader and the bowl. The leader which is set near the coast has one foot meshes. In the bowl the meshes at first are also about one foot, but become smaller as they approach that portion which is made of ropes of straw. The net is fixed by stones, some of which are attached to the lower margin of the barrier, and others are put into nets and suspended by ropes of straw from the floats consisting of bundles of bamboo tied to the upper margin of the net. The leader is about 1150 ft. long and 20 ft. high, while the bowl is about 350 ft. long and 280 ft. wide. Two watchmen are always placed on a watch-tower to keep a lookout. When the fish enter the bowl along the barrier, a net which is placed at the entrance of the bowl is in the first place drawn up, and the fish are caught in the inner pound by gradually raising up the net of the pound. When, however, they do not enter the bowl directly, the entrance into the pound is closed with another net and the fish are driven into the bowl.

No. 68. Double Tunny Pound-net. (with fishing boats and watch-towers). 一五〇.

This like the preceding one is a fixed net and is used in the seas near Sendai in the northern part of Japan. It consists of a leader and a pouch. The former is about 1750 feet long and its meshes are about 5 feet; the latter is about 1740 feet in circumference and its two blind ends form the inner pound. There are five intercepting nets, viz., one at the entrance of the pouch, another on each side of this, and others at the entrance of each inner pound. These nets are usually allowed to hang down; but when the fish enter the pouch they are successively raised and lowered, so that the fish are

gradually driven into the inner pound. The whole net is provided with stones and with floats of unhewn timber. The meshes of the pouch vary from about one foot and four inches to about half an inch in length.

This net proves itself to have been constructed with a full knowledge of the habits of the fish for which it is intended. Owing to the presence of a rectangular bend in the barrier and the curvature of the pouch, the fish which have once entered the net can not possibly get out of it again. Moreover if a second shoal of fish comes after the first has entered the pouch, the latter is driven beyond the second intercepting net, and the net at the entrance of the pouch is opened; then the second shoal merely swims to and fro between the barrier and the entrance of the pouch for any length of time, and there is no fear of their escape.

In the watch-tower two men always keep a lookout, while below is a boat with six men. When the fish enter the net, word is given from the tower to the boat, and the intercepting nets are put into action. Moreover signals are made to the fishermen's huts on the shore, according to the number of fish.

PREPARATIONS OF TUNNY.

Tunnies are mostly eaten raw in Japan. Until recently the only methods of preservation were by salting and by smoking and drying; but now they are also canned and preserved in oil according to European methods.

No. 69. Tunny Drift-net. $\frac{1}{5}$.

This is used in the vicinity of the Bay of Tokyo. A single netting is about 275 feet long and 20 feet wide. Twelve such pieces (or "*mogai*" as the fishermen call them) are joined into a single net. The meshes are about 7 inches, and the knots are made so as to prevent sliding in either direction. A big rope is tied to the upper margin. In order to make the net float on the surface, the rope is made from the fibres of the palm (*Trachycarpus eximius*, Thumb.), and floats are attached to it at the distance of about every one foot and four inches. The rope of the lower margin is made of hemp, and no stones are attached to it.

This net is worked in the spring and in the open sea at a depth of 500-1000 feet. Many boats form a line and intercept the route of the fish, and the net is shot down the tidal current. While

being drifted one end of the net is kept tied to the boat, while the other end is attached to a float, with a floating signal and a lighted lamp.

No. 70. Salt Tunny.

No. 71. Smoked Dried Tunny.

The flesh is first boiled in water and then dried. It can be kept for any length of time without any alteration in its taste. It is daily used in Japanese households as a condiment, and is especially excellent as a stock for soup. 100 lbs. cost 12-15 *yen*.

No. 72. Tunny preserved in Oil.

BONITO FISHERY.

No. 73. *Thynnus polamys*, C. & V. (*Jap. Katsuno**)

No. 74. *Auxis tapeinosama*, Bleek. (*Jap. Sōda-Gatsuno*).

These two fishes, especially the first, are of prime importance in the fisheries of Japan; and the amount of their catch directly affects the monetary condition of the fishing villages. They are both migratory fishes. Coming in the spring in large shoals along with the *Kuro-Shimo* from the southern seas, they pass the summer about submarine rocks near the coast, and go back to the south in the autumn; but of the details of their routes, their habits, and the time and place of their spawning, nothing accurate is known. Large specimens often measure about one foot and five or six inches in length and weigh about twelve and a half pounds. The bonito as well as the *sōda* feeds on smaller fishes; but they have a very fastidious appetite, so that dead fish can not be used for bait. The *sōda* comes nearer the coast than does the bonito.

No. 75. Map showing Distribution of the Bonito and its Allies.

APPARATUS FOR BONITO FISHING.

Both nets and lines are used; but angling with bamboo rods is the chief means of fishing, and it has attained a high degree of perfection. The bonito being found chiefly near hidden rocks and in rapid currents, nets can not be used to advantage.

* Changed into *Gatsuno* when compounded with a prefix.

No. 76. Bonito Hooks.

A collection of hooks for fishing bonito used in various parts of Japan. They are of two kinds, viz., those used with true baits and those with artificial baits attached to them. In the latter the artificial baits are made to resemble both in form and color either sardines or squids.

No. 77. Bonito Angling.

A fishing scene off the Shiwono-Misaki in the province of Kii. The man in the middle of the boat, lifting up his right hand and holding a dipper in his left, is casting sardines into the water to attract the fish; two men near the stern with fishing rods in their left hands and with long bamboo rods in their right hands are throwing water on the bait by means of the spatulas attached to the end of the bamboo rods, so that the fish may not see the line and the hook above the bait; a man near the prow has succeeded in catching a fish and has just freed it from the hook by holding it under his arm; a man at the stern has caught a large fish, and a boy is about to raise it up with a hook. The man at the stern with his face turned toward the right side of the boat is the master. He is using a hook with artificial bait.

No. 78. Bonito Angling Boat (with sail, oar, and fishing rods).

$\frac{1}{10}$.

This has been made after the boats used in the province of Tosa.

No. 79. Bonito Circle-net (with barrel buoy). $\frac{1}{100}$.

This is used at the entrance of the Bay of Tokyo from the latter part of autumn to the early part of winter. The bunt is made of hemp, but the wings are made of straw. The net is made up of two halves each measuring about 1550 feet in length. The meshes are from about two inches and a half to five feet. To work this net, four boats with forty-eight men are required. Of these the two smaller boats serve as leaders searching out the shoal of fish and giving orders. When the signal is given, the other boats, which have hitherto carried the two halves of the net separately, join them together and encircle the shoal. The wings are gradually tucked in and the fish are driven into the bunt.

No. 80. Bonito Circle-net Fishing.

Two boats have already tucked in the whole of the wings up to the bunt, and are going to bail out the fish. In an upper corner of the figure two boats are shown carrying the two halves of the net separately and rowing for the fishing ground.

PREPARATIONS OF BONITO.

The Bonito is to a certain extent eaten raw; but nine-tenths of the fish caught are smoked and dried for preservation. Some are also preserved in salt, but very rarely.

No. 81. Smoked Dried Bonito.

A single fish is cut lengthwise along the spine and the lateral lines into four pieces, and the head, tail, fins, and bones are removed. The pieces are then well boiled, smoked, and dried. The bonito thus treated can be kept for any length of time without any change in its taste. It is shaved into small pieces and used as a condiment; smoked dried bonito being one of the necessities in Japanese culinary art. The shavings are also eaten by themselves with a little sauce added. Smoked dried bonito is also esteemed by some as a stock for soup. For this purpose the shavings are boiled with water, and the broth is then cleared by filtering. To the filtrate is then added sauce or other condiments, and an excellent soup is made.

No. 82. Mashed Bonito. (*Jap. Katsuwo-Demba*).

No. 83. Bonito Oil.

No. 84. Dry Scrap from Bonito Refuse.

No. 85. Bonito Smoking Furnace (with instruments attached thereto). $\frac{1}{4}$.

No. 86. Knives for Curing Bonito.

No. 87. Curing Bonito.

No. 88. Preparing Dried Smoked Bonito.

No. 89. *Cybium Niponium*. C. & V. (*Jap. Sawarā*).
Photograph.

- No. 90. *Uranoscopus asper*, T. & S. (*Jap. Temmondai-Okozé*).
Alcoholic specimen.
- No. 91. *Sillago Japonica*, T. & S. (*Jap. Shira-Gisu*).
Alcoholic specimen.
- No. 92. *Latilus argentatus*, C. & V. (*Jap. Ama-Dai*).
Alcoholic specimen.
- No. 93. *Trichodon Stelleri*, C. & V. (*Jap. Hitāhūtā*).
Alcoholic specimen.
- No. 94. *Platycephalus insidiator*, Forsk. (*Jap. Kochi*).
Alcoholic specimen.
- No. 95. *Trigla kumu*, Less. & Garn. (*Jap. Hōbō*).
Alcoholic specimen.
- No. 96. *Lepidotrigla microptera*, Gthr. (*Jap. Kanayashira*).
Alcoholic specimen.
- No. 97. *Gobius hexanema*, Bleek. (*Jap. Dainan-Hazé*).
Alcoholic specimen.
- No. 98. *Chirus hexagrammus*, Pall. (*Jap. Aināmé*).
Alcoholic specimen.
- No. 99. *Pelor Japonicum*, T. & S. (*Jap. Okozé*).
Alcoholic specimen.
- No. 100. *Centronotus nebulosus*, T. & S. (*Jap. Gimpo*).
Alcoholic specimen.
- No. 101. *Sphyræna obtusata*, C. & V. (*Jap. Kamusu*).
Alcoholic specimen.
- No. 102. *Mugil cephalotus*, C. & V. (*Jap. Bera*).
Alcoholic specimen.
- No. 103. *Mugil hæmatochilus*, T. & S. (*Jap. Menādā*).
Alcoholic specimen.
- No. 104. *PlatyGLOSSUS* sp. (*Jap. Bera*).
Alcoholic specimen.

COD FISHERY.

- No. 105. *Gadus Brandti*, Hilgd. (*Jap. Tārā**).
Photograph.

- No. 106. *Gadus chalcogrammus*, Pall. (*Jap. Saketō-Dōrā*).
Alcoholic specimen.

The cod is a gregarious bottom fish living at a depth of more than 500 feet and limited to those seas which are within the reach of cold currents. Cod fishing is mostly carried on in January and February when the fish come near the shore for spawning. In some places it comes up to a depth of about 100 feet, but in others it is never found at a depth of less than 650 feet. It feeds on herrings, lampreys, squids, and lobsters.

- No. 107. Map showing Distribution of Cod.

In this map the two species are treated indiscriminately; but the *Gadus Brandti* is the more abundant, the other species being found chiefly near Niigata.

APPARATUS FOR COD FISHING.

Both nets and lines are used. Of the latter the long line is more commonly used than the hand line. Of the former both pound-nets and gill-nets are used, but mostly gill-nets; the use of the pound-net being limited to a single locality.

- No. 108. Long Cod Line. Two Baskets.

This is used near Niigata in fishing for *Gadus chalcogrammus*. It is a line about 225 feet long bearing fifty-five snoods of about two feet each. Such a line is put into a shallow basket made of bamboo, and is called a "maki." A boat of six men uses eighty such "maki" tied end to end into a single line. At each end and in the middle of this line is tied a stone and a barrel buoy, the latter by means of a cord; also at the end of each "maki" are attached alternately a small stone and a float, so that the whole line may not lie flat on the bottom but be kept floating at intervals. For bait, sardines and squids, cut into pieces of convenient size, are used.

* Changed into *Dara* when compounded with a prefix.

No. 109. Cod Long Line Fishing.

No. 110. Hooks for Cod.

A collection of hooks for long line used in various parts of Japan. They have barbs and are also slightly twisted, but are not tempered.

No. 111. Cod Angling Boat (with apparatus attached). $\frac{1}{10}$.

No. 112. Cod Gill-net. $\frac{1}{3}$. One Netting (with stones, floats, and wooden grapnels attached).

This is a hempen net used along the shores of the Sea of Japan for catching *Gadus chalcogrammus*. For this purpose it is sunk to the bottom of the sea. A single piece is about 1212 feet long and about 5 feet high, and the meshes are about three inches. For floats, pieces of the varnish-tree or of *Paulownia imperialis* are used, and for grapnels stone and wood. A single boat uses several pieces joined together. (For *Gadus Brandti* nets with larger meshes and made of bigger cords are used.)

PREPARATIONS OF COD.

The fresh cod is but little eaten. It is mostly cured in different ways and exported to various countries.

No. 113. Pressed Cod.

This is made in Hokkaido after the American method. One hundred pounds cost about twelve *yen*.

No. 114. Opened Cod.

The opened cods are slightly salted and then dried in the sun. A hundred pounds cost five or six *yen*. The yearly produce represents about forty or fifty thousand *yen*.

No. 115. Salt Cod.

No. 116. Cod-liver Oil.

This is used exclusively for medicine. It is manufactured in Hokkaido and sold in bottles containing a pound each. A dozen of such bottles cost about two *yen* and forty *sen*. The yearly produce is increasing.

No. 117. *Ammodytes* sp.

Alcoholic specimen.

SOLE AND FLOUNDER FISHERIES.

- No. 118. *Pseudorhombus cinnamomeus*, Schleg. (*Jap. Kan-zō-Hiramé*).
No. 119. *Ps. olivaceus*, Schleg. (*Jap. Hiramé*).
No. 120. *Parophrys cornuta*, Schleg. (*Jap. Mita-Garei*).
No. 121. *Pleuronectes scutifer*, Schleg. (*Jap. Ishi-Garei*).
No. 122. *Pl. variegata*, Schleg. (*Jap. Hoshi-Garei*).
No. 123. *Plagusia Japonica*, Schleg. (*Jap. Ushinoshita-Garei*).
Alcoholic specimen.

Beside these there are still many species of flat-fish in Japan. They are all bottom fishes and spawn mostly in winter.

- No. 124. Map showing Distribution of *Pseudorhombus olivaceus*.

APPARATUS FOR FISHING FOR SOLES AND FLOUNDERS.

Both nets and lines are used ; but the former, of which gill-nets, trawls, and dredges are employed, are the chief means by which most of the market fish are obtained. The lines are either the long or the hand line.

- No. 125. Plaice Hand Line.

This is a double coil line about fifty fathoms long bearing thirty pieces of lead each weighing about 2½ oz. These pieces of lead serve to hold the line against the current. The distances between them grow less and less as we approach the hook. To the hook is attached a flat circular piece of lead, and beside this there is a long line for tying the bait, for which sardines, either fresh or salted, are used.

- No. 126. Pole-trawl for Soles and Flounders (with drag-ropes). 16.

This form of trawl for flat-fish is used in the seas near the province of Owari. It consists of a pouch with two wings and a netting stretched between their upper margins. The pouch is about twenty-one feet long, and its meshes are from a little less than one inch and a half to about two inches. The wings are about thirty feet long, and their meshes are about two inches. In order to prevent any damage to the pouch, a hempen netting with meshes of about three inches and a half is spread below it.

This net is worked with full sail at a depth of 100—200 ft. To keep the pouch and the wings open, a long pole is projected from each end of the boat, and to these the drag-ropes are tied.

No. 127. Pole-trawl Fishing for Soles and Flounders.

An evening scene. One boat has already let down the trawl; while the other has lowered the sail and is making preparations for trawling.

PREPARATIONS OF SOLES AND FLOUNDERS.

The flat-fish are mostly eaten raw, only a small proportion being dried for preservation. They are also pressed for oil.

No. 128. Plaice gill-net. $\frac{1}{3}$. One Netting.

This is made of hemp. A single netting is about 165 ft. long and 6 ft. high; and the meshes are about six inches. To the upper margin is attached a strong rope of straw with wooden buoys, and to the lower a similar rope with stones. When being used, from ten to twenty of such nettings are joined into a single net, to one end of which is then tied a wooden grapnel and a float. The net is used on sandy bottoms at the depth of 50—60 feet.

No. 129. Sole Gill-net Fishing.

Water color painting.

No. 130. Dried Flounder.

Dried flounders are chiefly made on the coasts of the Inland Sea. They are mostly sold to the mountain villagers.

No. 131. Flounder Oil.

This is a by-product of the preceding. It is used for lighting in some retired localities.

No. 132. Flounder Scrap.

Made by pressing flounders.

No. 133. *Silurus asotus*, L. (*Jap. Nāmāzu*).

Alcoholic specimen.

No. 134. *Saurida argyrophanes*, Richards. (*Jap. Eso*).

Alcoholic specimen.

No. 135. *Cyprinus carpio*, L. (*Jap. Koi*).

Alcoholic specimen.

No. 136. *Carassius auratus*, L. (*Jap. Funa*).

Alcoholic specimen.

No. 137. Weir. 130.

This is the form used in Lake Biwa in the province of Omi. It is made of bamboo splints and for posts bamboo poles are used. The weir consists of three enclosures which, however, have no intimate relation with one another but are complete each by itself. Of these three, that nearest the bank is small and low, being about 10 feet high, and the intervals between the splints being a little over one-fourth of an inch wide. The next one is a little larger, being about 12 feet high with the intervals between the splints about $\frac{3}{4}$ of an inch. The last enclosure is largest, and is about 15 feet high with the intervals between the splints about one and three-fourth inches. It is intended mainly for carps and crucian carps.

No. 138. *Carassius auratus*, L. var. *Ryūkin*.

No. 139. ,, ,, ,, *Wakin*.

No. 140. ,, ,, ,, *Maruko*.

We distinguish these three varieties of the gold-fish, and various other names are given according to the forms of the caudal fin. The most costly form is the so-called "lion-head" variety of Maruko, which, as may be seen from the specimen here exhibited, has numerous warts on its head. A pair of this variety, male and female, often costs more than one hundred *yen*; and even the most common specimen can not be obtained for less than five *yen*.

The gold-fish spawns from the latter part of April. The cultivators usually make their fish spawn three times with intervals of about one week.

No. 141. Water Color Painting of Gold-fish.

No. 142. *Barbus Schlegelii*, Gthr. (*Jap. Nī-Goi*).

Alcoholic specimen.

No. 143. *Leuciscus Hakuensis*, Gthr. (*Jap. Ugui*).

Alcoholic specimen.

No. 144. *Misgurnus anguillicaudatus* Contor. (*Jap. Dojo*).

Alcoholic specimen.

- No. 145. *Scrombresox saira*, Brevoort. (*Jap. Samma*).
Alcoholic specimen.
- No. 146. *Hemirhamphus sajori*, Schleg. (*Jap. Sagori*).
Alcoholic specimen.
- No. 147. *Exocætus agoo*, Schleg. (*Jap. Tobi-Uwo*).
Alcoholic specimen.
- No. 148. *Onchorhynchus Perryii*, Hilgd. (*Jap. Māsu*).
Photograph.

SALMON FISHERY.

- No. 149. *Onchorhynchus Haberi*, Hilgd. (*Jap. Sōké*).
Photograph.

The salmon is found in the northern parts of Japan, especially in Hokkaido. It ascends the rivers of those parts for spawning; and at that season it undergoes a great change in shape as well as in color. It usually attains the length of about three feet, and weighs 12–17 lbs., but large specimens sometimes measure about four feet in length and weigh about twenty pounds.

- No. 150. Map showing Distribution of Salmon.

APPARATUS FOR SALMON FISHING.

In fishing for salmon drift-nets, tow-seines, circle-nets, and pound-nets are used; but the first and the last are most commonly used.

- No. 151. Salmon Pound-net (with barrel buoys, grapnels, etc.).
 $\frac{1}{50}$ (leader shortened).

This is used along the coast of the province of Tokachi in Hokkaido. It consists of a large bowl made of hemp and a leader made of straw. The latter is 750 feet–1500 feet long, and its meshes are $2\frac{1}{2}$ –7 inches. Intercepted by the leader, the fish follow it and enter the bowl. At this time a netting which has hitherto been kept lowered is raised, and the mouth of the bowl is closed. The fish are landed by gradually tucking in the bowl.

- No. 152. Sample of Netting for Salmon.

- | | | | |
|----------|---|---|---|
| No. 153. | ” | ” | ” |
| No. 154. | ” | ” | ” |
| No. 155. | ” | ” | ” |

No. 156. Salmon Drift-net. $\frac{1}{3}$. One Netting (with floats).

This is the one used in the provinces of Uzen and Ugo. It is made of hemp, and a single netting is about 175 feet long and 8½ feet high. Floats are tied to the upper margin but the lower margin has no weight attached to it. It is worked by night at the mouths of rivers from about the middle of October till the first part of December. Eight or ten nettings are usually joined into a single net, and are shot down the stream.

PREPARATIONS OF SALMON.

No. 157. Canned Salmon.

This is largely made by the Sumihara and the Fujino Co., in Hokkaido. More than two hundred thousand cans, amounting in value to about 24,000 *yen*, are sold every year.

No. 158. Canned "Masu" (*Onchorhynchus Perryi*).

No. 159. Smoked Salmon.

This is also made in Hokkaido. The skin and flesh are not separated, and the latter with its bright red color looks just as if it were fresh. Salmon are not smoked in large quantities, as the demand is not very great. The price is accordingly high; a single box containing ten fish costing about *yen* 2.50.

No. 160. Salt Salmon.

This is a product of Hokkaido and forms the greater bulk of the Salmon cured for preservation. The price has risen in recent years in consequence of exportation, and a single fish now costs 30-40 *sen*.

AYU FISHERY.

No. 161. *Plecoglossus altivelis*, Schleg. (*Jap. Ayu*).

Alcoholic specimen.

The *Ayu* is very highly esteemed among the fresh water food-fishes. It lives in sandy rivers, and is found in almost all parts of Japan. It feeds chiefly on diatoms and other lower algae. Large specimens measure sometimes more than a foot in length. It spawns in autumn in shallow rapids.

- No. 162. Map showing Distribution of *Plecoglossus altivelis*.

APPARATUS FOR AYU FISHING.

Nets, lines, and traps are used. Beside these there is a peculiar mode of fishing with tame cormorants called *ukai*.

- No. 163. Fishing Rods for Ayu (With scrip, dipper, and net-bag).

- No. 164. Hooks for Ayu.

A collection of the different forms of fly hooks used all over Japan, and of ordinary hooks employed in different parts of the country.

- No. 165. Ayu Scare-cord Net (with scare-cord). $\frac{1}{20}$.

This consists of a receiving-net and a scare-cord. The former is made of hemp, and its meshes are about one inch. The scare-cord is also made of hemp and is from two hundred to two hundred and fifty feet in length. It bears at intervals short branch lines, also of hemp, to the extremities of which are attached feathers of the cormorant. A single man keeps the receiving-net open against the current while four men scare the fish down the stream with the cord, and drive them into the net.

- No. 166. Silken Casting-net.

- No. 167. Hempen Casting-net.

- No. 168. Ayu Fishing with Tame Cormorants, or *Ukai*. About $\frac{1}{12}$.

A single *ukai*-boat of the River Nagara in the province of Mino. A dragon is placed at the prow to help the maneuvers of the cormorants. The men are four in number, of whom two manage the boat and the other two the cormorants. The skill with which the men handle the birds is truly wonderful. The man near the prow usually manages twelve birds, and when one of them swallows four or five fish he draws it to him by the cord with which it is tied, and by pressing its throat squeezes the fish out into a tray beside him. In doing this, he is always sure to pick out the right cord, and not the least entanglement occurs. The large basket with the wooden cover is used for keeping the cormorants in. This mode of fishing is said to have begun more than one thousand years ago.

PREPARATIONS OF AYU.

The *Ayu* is highly esteemed in the fresh state; but it is also boiled and dried, or preserved in salt and *saké*-dregs, so that it may be kept for a long time or transported to distant countries. The *Ayu* thus treated is highly esteemed, and is sold at a high price.

No. 169. Photograph of Ayu Fishing with Tame Cormorants.

No. 170. Broiled Ayu.

This is made in the province of Aki. The price of a single fish is about ten *sen*.

No. 171. Ayu preserved in Saké-dregs.

These are stuffed with their roe and preserved in the dregs of *saké*, or Japanese wine. The price of a single fish is about fifty *sen*.

No. 172. Dried Salt Ayu.

No. 173. *Salanx microdon*, Bleek. (*Jap. Shira-Uico*).

Alcoholic specimen.

No. 174. *Engraulis Japonicus*, Houtt. (*Jap. Hishiko*).

Alcoholic specimen.

No. 175. Boiled Dried Anchovy.

No. 176. Dried Anchovy.

No. 177. *Chatoëssus punctatus*, Schleg. (*Jap. Konoshire*).

Alcoholic specimen.

SARDINE FISHERY.

No. 178. *Clupea melanosticta*, Schleg. (*Jap. Iwashi*).

The sardine is the most important of the useful fish of Japan, and the economic condition of the whole fishing industry is intimately connected with the amount of its catch. This is due to the fact that the sardine always comes in enormous shoals and is caught almost everywhere along the coast. Large areas of the surface of the sea are sometimes changed in color by the presence of a single shoal. The sardine is a migratory fish, going from south to north in spring and returning again to the south in autumn. The shoal usually swims at the surface against the

current, but is said also to sink at times to the bottom. The sardine feeds on small crustaceans such as *Mysis*, and is attracted by torch-light. Spawning takes place in the spring.

No. 179. Map showing Distribution of Sardines.

APPARATUS FOR SARDINE FISHING.

Both nets and lines are used. The latter are, however, limited to certain small districts, while the former are extensively used and have been greatly improved, there being no less than twenty different types of them.

No. 180. Sardine Ground-Seine (with barrel-buoy and drag-ropes).

$\frac{1}{100}$.

This net is used at Kujūkuri in the province of Kazusa. It consists of a pocket and two wings. The pocket is made of hemp, with meshes of from $\frac{3}{4}$ to $\frac{5}{8}$ of an inch and is about 150 ft. long. The wings are about 1150 feet long, and are made partly of hemp and partly of straw. The hempen portion has meshes of from $\frac{3}{4}$ of an inch to about two inches and a half; and the straw portion has meshes of about one foot. The wings and the pocket can be separated from each other. The drag-ropes are made of three strands coiled together, and are a little over one inch thick and 105 or 110 feet long. From sixty to eighty such ropes are usually provided ready for use.

If a shoal is detected two boats row out with the separate portions of the net. A little before reaching the shoal, the pocket and the wings are joined together; the former is then cast first and the shoal is gradually encircled with the wings. When these come to an end, the drag-ropes are cast and the net is hauled on shore.

No. 181. Sardine Ground-seine Fishing.

A scene at the Kujūkuri in the province of Kazusa.

No. 182. Sardine Circle-net. $\frac{1}{50}$.

This net is called *hassaku-ami* by the native fishermen. It is a circle-net, and is used off the coast of the province of Hidachi. It consists of a central portion and two wings. It is usually separated at the middle into two equal portions, and these are joined together when the net is being used. The central portion is made of hemp, and is 400 ft. long, the meshes being from about $\frac{3}{8}$ of an inch to a

little over one inch (about $1\frac{1}{2}$ in.). The wings are made of straw, and are about 700 ft. long; the meshes being one foot. To work the net four boats with over fifty men are required. Two of the boats carry the net separately and act according to the orders of the other two boats which go in search of the fish.

No. 183. Sardine Circle-net Fishing.

No. 184. Eight-armed Net. $\frac{1}{25}$.

This is a flat-net used on the Pacific shores of Japan. It is almost square in shape, and the meshes are from a little over half an inch to a little over one inch (about $1\frac{1}{2}$ in.). To one side of the square are attached floats, and to the remaining three sides ropes are tied. To the bottom of the ropes of the lower margin large weights of lead are attached. When in use the ropes of the three sides are held by three boats, and the net is lowered obliquely against the current. When the shoal of fish comes over it, the ropes are raised and the net is gradually drawn up; the fish being finally transferred to the boats.

No. 185. Sardine Fishing with Eight-armed Net.

The shoal has been detected, and the net has just been lowered.

No. 186. Tuck-seine. $\frac{1}{50}$.

This net is used on the Pacific shores of the Main Island, and closely resembles the purse-net of the American fishermen. It is about 600 feet long and 65 or 70 feet wide at the two ends. The meshes are from about three-fourths of an inch to a little over one inch. When not in use, the net is carried in equal portions by two boats.

No. 187. Tuck-seine Fishing.

The net has been partly hauled in, and the fish have been gathered in the central portion.

No. 188. Dip Net. $\frac{1}{10}$. (Shown with the boat, the net lowered).

This net is used on the Pacific shores of the Main Island. It is nearly square each side about 35 feet, and the meshes are from about half an inch to about $1\frac{3}{4}$ in. To prepare it for use, one side is stretched and made fast lengthwise to a bamboo rod, and to the opposite side three ropes with stones attached are tied. To each end of the bamboo rod another rod of bamboo is made fast.

To work this net, the right side of the boat is, in the first place, turned against the current and the net is made to dip down from

the left side ; the bamboo rod to which one side of the net has been made fast is kept horizontal at a short distance from the boat by means of the two other rods. Some shrimp (*Mysis*) are then strewn on the right side, and the fish are called together ; some more are then strewn on the left side, and when the fish come over it, the net is drawn up by means of the ropes.

This net is used in getting the sardines used as bait for the bonito. It is therefore made on a small scale, and the fish caught are kept alive in the well of the boat.

No. 189. Dip Net Fishing.

On one side of the boat is lowered the net, and on the other toll bait is being strewn.

No. 190. Sardine Drift-net. $\frac{1}{16}$. (One Netting, with barrel buoys).

This is the form used in the Bay of Tokyo. A single netting is about 150 ft. by about 35 ft., and is made of hemp. The meshes are from about $1\frac{1}{2}$ in. to about $1\frac{3}{4}$ in. The cord of the upper margin is made of hemp, and a lead is attached at every three feet. The rope of the lower margin is on the contrary made of the fibres of the palm (*Trachycarpus excelsa*), and at about every four inches a wooden float is attached.

A single boat with six or seven men uses seven or eight nettings joined together. Fifty or sixty such boats usually form themselves into a line and the net is shot across the course of the sardines. This net is worked at night.

No. 191. Sample of Netting for Sardines.

No. 192. " " " " "

No. 193. " " " " "

No. 194. " " " " "

PREPARATIONS OF SARDINES.

The sardines are caught in enormous numbers, and the greater part are dried, and made into fertilizer either entire or after the oil has been extracted. Recently, however, sardines have been canned and smoked, and their value has consequently increased.

No. 195. Sardines in Oil.

No. 196. Smoked Sardines.

Promises to become an article of export

- No. 197. Gill-stuck Sardines.
Used for food in mountainous districts.
- No. 198. Back-split Sardines.
Used for food in mountainous districts.
- No. 199. Crude Sardine Oil.
- No. 200. Refined Sardine Oil.
2,500,000 lbs. are being yearly produced. It is exported to various countries of Europe and America. It is a by-product of the fish-scrap.
- No. 201. Crude Sardine Wax.
- No. 202. Refined Sardine Wax.
- No. 203. Dried Fish-scrap.
- No. 204. Dried Sardines (Fertilizer).
- No. 205. Sardine Press. $\frac{1}{4}$.
This is the form hitherto in use for making fish-scrap.
- No. 206. Packed Fish-scrap. $\frac{1}{4}$.
- No. 207. Improved Sardine Press. $\frac{1}{4}$.
- No. 208. Water Color Painting of Sardine Press.

HERRING FISHERY.

No. 209. *Clupea harengus*, L. (*Jap. Nishin*).

The herring is economically a very important fish in Japan. From the latter part of spring to the beginning summer, it comes in large shoals to the adjacent sea; and deposits its eggs on stony bottoms overgrown by sea-weeds. The most famous fishing ground is the west coast of Hokkaido; but the fish is found more or less in all parts of our northern seas where there is a cold under-current in winter and spring.

No. 210. Map showing Distribution of Herring.

APPARATUS FOR HERRING FISHING.

Herring fishing is carried on only by means of nets. Of these gill-nets, flat-nets, and pound-nets are used.

No. 211. Herring Pound-net. $\frac{7}{50}$ (leader shortened).

This is a fixed net used in Hokkaido. The pound is rectangular in shape and its nettings are made of hemp. The longer side of the pound is about 170 feet long, and its meshes are about three inches in the front part, while in the greater portion of the back part they are about one inch. On both sides of the entrance of the pound are the wings made of straw rope with the meshes about three inches. The leader is perfectly straight, and is 500–1500 feet long. It is also made of straw rope, and the meshes are about five inches.

The most striking feature of this net is the so-called bag-net boat (Jap. *vāku-āmi-buné*), that is, a boat with a flat bag-shaped net suspended under it from the sides. It is placed at the closed end of the pound, and the bag-net is joined to the pound by one of its sides. When a shoal of herring enters the pound, a boat at its entrance takes up the rope and draws up the net, and on its approaching the end of the pound, the fishermen in the bag-net boat allow the joining line of the bag-net and the pound to sink somewhat below the surface of the sea, and the fish are passed on into the former. The joining line is then again raised, and when, after repeating this process a number of times, the bag-net is filled, the boat leaves its post to be taken by another, and rows for the coast where the fish are bailed.

No. 212. Sample of Netting for Herring.

No. 213. " " " " "

No. 214. " " " " "

No. 215. " " " " "

No. 216. " " " " "

No. 217. " " " " "

No. 218. Herring Gill-net. $\frac{1}{3}$. One Netting.

A single netting is about 20 feet by 7 feet, and the meshes are about two inches. A single boat of two or three men uses usually 25–50 nettings, and five nettings are joined into a single group. Between each netting a weight of 4–5 lbs. is attached, and to each group a float and a weight are tied. A number of these groups are set in a single line parallel to the coast.

PREPARATIONS OF HERRING.

No. 219. Salt Herring.

This is made in Hokkaido. The yearly produce is somewhat increasing. Price per barrel about one *yen*.

No. 220. Smoked Herring.

This is made in Hokkaido and the northern provinces of the Main Island. The sample here exhibited has been prepared by the German method. The current price is 20 *sen* for ten fish.

No. 221. Dried Herring Sliver.

No. 222. Split Herring.

No. 223. Back-split Herring.

These three are used for food in retired districts among the mountains. They are all sun-dried. The dried sliver is most largely used.

No. 224. Dried Herring Roe.

No. 225. Herring Scrap.

This is the substance that remains after boiled herrings have been pressed for oil. It is the best fish fertilizer and is consequently highly valued, and produced in large quantities. In 1889, 4,002,145 *yen*'s worth was produced. Price per one hundred pounds *yen* 2.50.

No. 226. Herring Bone.

No. 227. Dried Herring Milt.

No. 227 bis. Herring Refuse.

These two are used as fertilizers and are the dried refuse of slivered herrings. They are both produced in abundance.

No. 228. Crude Herring Oil.

No. 229. Refined Herring Oil.

No. 230. Crude Herring Wax.

No. 231. Refined Herring Wax.

17,500,000 lbs. of the oil are produced yearly. Both the oil and the wax have a large demand in Japan, and are also exported in large quantities.

No. 232. *Etrumeus micropus*, Bleek. (*Jap. Urume-Iwashi*).
Alcoholic specimen.

No. 233. *Anguilla Bostoniensis*, Ayres. (Jap. *Uuagi*).
Alcoholic specimen.

No. 234. Canned Broiled Eel (*Ang. Bostoniensis*).

This is made by the Kairiku-Sha of Tokyo. One dozen cost three *yen*. It is highly esteemed by the Japanese, and has recently been exported to San Francisco.

No. 235. *Murænoxa cinereus*, Forsk. (Jap. *Hūmo*).
Alcoholic specimen.

No. 236. Canned Sea Eel. (*Muræn. cinereus*).

No. 237. *Orthogoriscus mola*, L. (Jap. *Mambō*).
Photograph.

No. 238. *Carcharius glauca*, L. (Jap. *Yoshikiri-Zamé*.*)
Photograph.

No. 239. *Zygæna malleus*, Risso. (Jap. *Shumoku-Zamé*).
Photograph.

No. 240. *Mustellus manazo*, Bleek. (Jap. *Hoshi-Zamé*).
Photograph.

No. 241. *Notidanus Indicus*, M. & H. (Jap. *Abura-Zamé*).
Photograph.

No. 242. *Lamna glauca*, M. & H. (Jap. *Awo-Zamé*).
Photograph.

No. 243. *Alopecias vulpus*, Gm. (Jap. *Onaga-Zamé*).
Photograph.

No. 244. *Rhina squatina*, L. (Jap. *Kusu-Zamé*).
Photograph.

No. 245. *Trygon pastinaca*, L. (Jap. *Aka-Ei*).
Photograph.

No. 246. *Octopus octopodia*, L. (Jap. *Ma-Dako*.†)
Alcoholic specimen.

No. 247. *Octopus megalocyathus*, Canthony. (Jap. *Yanagi-Dako*).
Alcoholic specimen.

* *Samé*=shark, changed into *Zamé* when compounded with a prefix.

† *Tuko*=cuttle-fish, changed into *Dako* when compounded with a prefix.

- No. 248. *Octopus ocellatus*, Gray. (*Jap. Ii-Dako*).
Alcoholic specimen.
- No. 249. *Ommastrephes Oualaniensis*, Lesson. (*Jap. Surumé-Ika*).
Alcoholic specimen.
- No. 250. *Loligo vulgaris*, Lam. (*Jap. Yari-Ika*).
Alcoholic specimen.
- No. 251. *Sepioteuthis Lessoniana*, Fer. & Orb. (*Jap. Awori-Ika*).
Alcoholic specimen.
- No. 252. *Sepia* sp. (*Jap. Hari-Ika*).
Alcoholic specimen.
- No. 253. *Rapana bezoar*, L. (*Jap. Aka-Nishi*).
- No. 254. *Triton Sauliæ*, Reeve. (*Jap. Hora-Gai*.*)
- No. 255. *Turbo cornutus*, Gmelin. (*Jap. Sazai*).
- No. 256. *Haliotis gigantea*, Chem. (*Jap. Awabi*).
- No. 257. *Haliotis verginea*, Chem. (*Jap. Tokobushi*).
- No. 258. *Lutraria Nullatli*, Conrad. (*Jap. Mirukui*).
- No. 259. *Siliquaria constricta*, Lamarck. (*Jap. Agemaki*).
- No. 260. *Mactra sulcataria*, Desh. (*Jap. Baka-Gai*).
- No. 261. *Trigonella Sachalinensis*, Schrenck. (*Jap. Uba-Gai*
or *Hokki-Gai*).
- No. 262. Canned *Trigonella*.
This is made by the Kairiku-Sha of Tokyo. Price per dozen
yen 1.50.
- No. 263. *Cytherea meretrix*, L. (*Jap. Hamaguri*).
- No. 264. *Dosinia Troscheli*, Lischke. (*Jap. Manju-Gai*).
- No. 265. *Tapes Philipinarum*, Adam & Reeve. (*Jap. Asari*).
- No. 266. *Corbicula atrata*, Prime. (*Jap. Shijimi*).
- No. 267. *Cardium Japonicum*, Dkr. (*Jap. Tori-Gai*).
- No. 268. *Tridacna gigas*, L. (*Jap. Shako-Gai*).

* *Kai*=shell-fish, changed into *Gai* when compounded with a prefix.

- No. 269. *Arca inflata*, Reeve. (*Jap. Aka-Gai*).
No. 270. *Arca subrenata*, Lischke. (*Jap. Sarubo*).
No. 271. *Arca granosa*, L. (*Jap. Hui-Gai*).
No. 272. *Mytilus crassitesta*, Lischke. (*Jap. I-Gai*).
No. 273. *Pinna Japonica*, Reeve. (*Jap. Tairagi*).
No. 274. *Pinna* sp. (*Jap. Kuro-Mabé*).
No. 275. *Avicula Martensii*, Dkr. (*Jap. Akoya-Gai*).
No. 276. *Pecten Yessoensis*, Jay. (*Jap. Hotate-Gai*).
No. 277. *Pecten laqueatus*, Sow. (*Jap. Itaya-Gai*).
No. 278. *Ostrea cucullata*, Born. (*Jap. Kàki*.*)
No. 279. *Ostrea denselamellosa*, Lischke. (*Jap. Itabo-Gaki*).

These shell-fish are useful for food and for various industrial purposes. The oyster, *Avicula Martensii*, *Arca granosa*, *Macra sulcaturia*, and *Cardium Japonicum* are cultivated in various parts of Japan.

- No. 280. Oyster Culture Ground.
No. 281. " " "
No. 282. Canned Oyster.

This is largely produced in Hiroshima and Hokkaido. The sample here exhibited is from Hiroshima. Price per dozen yen 1.50.

SHRIMP AND LOBSTER FISHING.

- No. 283. *Palinurus Japonicus*, Gray. (*Jap. Ise-Ebi*).
No. 284. *Peneus canaliculata*, Oliv. (*Jap. Kuruma-Ebi*).
No. 285. *Peneus ensis*, De Haan. (*Jap. Shiba-Ebi*).
No. 286. *Palæmon longipes*, De Haan. (*Jap. Tenjyā-Ebi*).
No. 287. *Palæmon* sp. (*Jap. Numā-Ebi*).
No. 288. *Squilla oratoria*, De Haan. (*Jap. Shāko*).
No. 289. *Mysis* sp. (*Jap. Ami*).

Alcoholic specimen.

* *Kàki*=oyster, changed into *Gàki* when compounded with a prefix.

Besides these there are still many other species of shrimps and lobsters in Japan. They are all used for food or bait, and are economically very important. *Palinurus Japonicus*, or the Spiny Lobster, lives on stony bottoms of the Pacific shores washed by warm currents; but the other species are mostly found in bays, and prefer sandy or muddy bottoms. They usually hide themselves during the day, and go out in search of food at night.

No. 290. Map showing Distribution of Shrimps and Lobsters.

APPARATUS FOR FISHING FOR SHRIMPS AND LOBSTERS.

The Spiny Lobster is caught with gill-nets, while the other smaller forms are caught either with trawls or flat-nets, or with traps.

No. 291. Lobster-trawl. $\frac{1}{10}$.

This is a hempen net extensively used in the Inland Sea, and closely resembles the trawl for catching soles already described. The only points of difference are the comparative lightness of the weight used, and the stem of bamboo used for keeping the mouth of the trawl open. The former circumstance is due to the fact that this trawl is used on muddy bottoms. The purse is about fourteen feet long, and the wings are about eighteen feet in length. The meshes are a little less than half an inch in the posterior part of the purse, and from half an inch to a little over five-eighths of an inch in the remaining portion. The drag rope is from three hundred to four hundred feet long. This trawl is worked under a good wind, and two or three are usually attached to a single boat containing two men.

No. 292. Lobster Gill-net. One Netting.

This is a hempen net sunk to the bottom for catching the Spiny Lobster. It is about thirty-five feet long and only about three feet wide, and is therefore band-shaped. The meshes are one or two inches. A single boat usually carries two men, and uses several dozens of nettings joined into a single net to one end of which is then tied a stone and a float. The whole is then sunk in the evening in rocky places ten to fifty feet deep, and taken out the next morning.

Nos. 293 & 294. Prawn Pots.

These are used in Lake Biwa in the province of Ōmi. They are made of bamboo splints. At the entrance is a funnel-shaped piece with its smaller end projecting into the interior, so that any shrimp that has once entered it can not again get out. When being used, dozens of these traps are tied to a long rope, and crushed shell-fish (*Corbicula* or *Paludina*) are put within each; then the whole is sunk to the bottom. They are taken out from time to time and the shrimps are caught.

PREPARATIONS OF SHRIMPS AND LOBSTERS.

No. 295. Canned Spiny Lobster.

This has been made after the manner of the boiled lobster of the Americans. One dozen one-pound cans cost *yen* 1.20.

No. 296. Shelled Shrimp.

Pencus canaliculata or *P. ensis* boiled and deprived of their shells. About 300,000 *yen* worth is produced annually. It is one of the chief exports to China.

No. 297. *Portunus pelagicus*, Fabr. (*Jap. Gazami*).
Stuffed.

No. 298. *Lithodes Camschatica*, Tilesius. (*Jap. Ibara-Gani*.*)
Stuffed.

No. 299. *Inachus* sp. (*Jap. Taraba-Gani*).
Stuffed.

No. 300. *Grapsus Japonicus*, De Haan. (*Jap. Mokuu-Gani*).
Stuffed.

USEFUL ALGÆ.

No. 301. *Porphyra vulgaris*, Ag. (*Jap. Amanori*).

This sea-weed grows near the mouths of rivers in various parts of Japan. It is cultivated on a large scale in the Bay of Tokyo. About the time of the autumnal equinox, branches of bamboo and

* *Kani*=crab, changed into *Gani* when compounded with a prefix.

of various trees are stuck into the bottom of the sea, and the sea-weed is allowed to grow on them; the fronds being cut away from the top as they grow. The alga wholly dies away about the time of the vernal equinox. The article prepared for commerce is known as *asakusa-nori* and is highly esteemed both for food and as a condiment. The weed is but seldom eaten fresh and nearly always is made into a thin sheets like paper, and dried for preservation.

No. 302. Dried Porphyra.

This is heated over the fire and eaten with broth, or by itself with a little sauce. It is also used for various other culinary purposes. One hundred sheets cost from fifty *sen* to one *yen*.

No. 303. Broiled Porphyra.

No. 304. Porphyra Twigs and Preparation.

Water color painting.

No. 305. *Gelidium corneum*, Lamour. (*Jap. Tengusa*).

This sea-weed grows on the coasts of various parts of Japan on rocky bottoms at a depth of from about ten to one hundred and twenty-five feet. It grows in clusters and is never found in bays that have no open communication with the ocean. It is said to germinate in early spring and die away in autumn. The best harvesting season is summer.

No. 306. Dried Sea-weed Jelly.

This is made from the above-mentioned species, and is largely used both for food and as glue. It has also recently come to be used for purifying *saké* or Japanese wine. Added to the already large demand for home use, its exportation has recently increased. In 1891 the exports alone amounted to 454,000 *yen*.

No. 307. Crimson Sea-weed Jelly.

This is the common sea-weed jelly colored with bukkum wood.

No. 308. *Glœopeltis intricata*, Suring. (*Jap. Fukuro-Funori*).

Gl. coliformis, Suring. (*Jap. Funori*).

Both these species are largely used in making glue. They grow on rocks near the coasts of the warmer parts of Japan.

No. 309. Dried Sea-weed Glue.

This is made indiscriminately from the above two species, and is largely used to impart lustre and stiffness to various textile fabrics. It is also used for various other purposes, according to which it is refined in various degrees. The price of a single sheet (about 5 ft. by 3 ft.) of the most refined form is fifty *sen*.

N.B.—We very much regret that by a most unfortunate circumstance one species of Echinodermata, *Stichopus Japonicus*, which is one of the important fisheries-products of Japan was not included in the collection.

